

Federated Learning of Generative Image Priors for MRI Reconstruction

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Abstract

Multi-institutional efforts can facilitate training of deep MRI reconstruction models, albeit privacy risks arise during cross-site sharing of imaging data. Federated learning (FL) has recently been introduced to address privacy concerns by enabling distributed training without transfer of imaging data. Existing FL methods employ conditional reconstruction models to map from undersampled to fully-sampled acquisitions via explicit knowledge of the accelerated imaging operator. Since conditional models generalize poorly across different acceleration rates or sampling densities, imaging operators must be fixed between training and testing, and they are typically matched across sites. To improve patient privacy, performance and flexibility in multi-site collaborations, here we introduce Federated learning of Generative Image Priors (FedGIMP) for MRI reconstruction. FedGIMP leverages a two-stage approach: cross-site learning of a generative MRI prior, and prior adaptation following injection of the imaging operator. The global MRI prior is learned via an unconditional adversarial model that synthesizes high-quality MR images based on latent variables. A novel mapper subnetwork produces site-specific latents to maintain specificity in the prior. During inference, the prior is first combined with subject-specific imaging operators to enable reconstruction, and it is then adapted to individual cross-sections by minimizing a data-consistency loss. Comprehensive experiments on multi-institutional datasets clearly demonstrate enhanced performance of FedGIMP against both centralized and FL methods based on conditional models.